

CLAIMS

1. An air distribution unit for use in a rack that holds rack-mounted equipment, the air distribution unit comprising:

5 a housing defining an interior chamber, at least one intake vent defined in a front panel of the housing and configured to provide fluid communication between the interior chamber and an area external to the housing, and at least one exhaust vent defined in a side panel of the housing, the housing being configured to be disposed in the rack and to direct air from the interior chamber substantially laterally through the at least one
10 exhaust vent when coupled to the rack; and

at least one fan coupled to and disposed within the housing parallel to a top panel and a bottom panel of the housing and configured to draw air from the area external to the housing through the at least one intake vent, and to force the drawn-in air out of the air distribution unit through the at least one exhaust vent.

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2. The air distribution unit of claim 1 wherein the housing is configured to be mounted into the rack such that the front panel of the housing is disposed adjacent a front side of the rack.

20 3. The air distribution unit of claim 1 wherein the housing includes a midplate disposed in the interior chamber and spaced from and parallel to a top panel of the housing and a bottom panel of the housing, the midplate dividing the interior chamber into two plenums, wherein an upper plenum is defined between the top panel and the midplate in fluid communication with the intake vent and a lower plenum is defined

below the upper plenum between the midplate and the bottom panel in fluid communication with the exhaust vent.

4. The air distribution unit of claim 3 wherein the at least one fan is disposed in the
5 lower plenum in fluid communication with the exhaust vent and in fluid communication with the upper plenum and the intake vent.

5. The air distribution unit of claim 4 wherein the midplate defines at least one intake port, the at least one intake port being associated with a corresponding fan
10 disposed in the lower plenum, and wherein the fan is configured and disposed such that at least a portion of the fan aligns with the corresponding intake port, each fan being configured to draw air from the upper plenum through the corresponding intake port into an interior of the fan and to force drawn-in air radially outward through the exhaust vent.

15 6. The air distribution unit of claim 5 wherein the lower plenum includes one or more dividing walls disposed between the midplate and the bottom panel that divide the lower plenum into one or more air paths, and wherein the at least one fan is disposed in one of the air paths, the air path in which the at least one fan is disposed being in fluid communication with the exhaust vent.

7. The air distribution unit of claim 5 wherein the upper plenum includes one or more dividing walls disposed between the top plate and the midplate that divide the upper plenum into one or more air paths, and wherein the at least one intake port is disposed in fluid communication with one of the air paths, the air path with which the intake port is in 5 fluid communication being in fluid communication with the intake vent.

8. The air distribution unit of claim 4 further comprising multiple power inputs and a control circuitry module electrically coupling the power inputs to the at least one fan, the control circuitry module being configured to disconnect a first of the power inputs from a 10 first fan and connect a second of the power inputs to the first fan in response to a loss of power on the first power input.

9. The air distribution unit of claim 1 wherein the housing includes a midplate disposed in the interior chamber and spaced from and parallel to a top panel of the 15 housing and a bottom panel of the housing, the midplate dividing the interior chamber into two plenums, wherein an upper plenum is defined between the top panel and the midplate in fluid communication with the exhaust vent and a lower plenum is defined below the upper plenum between the midplate and the bottom panel in fluid communication with the intake vent.

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10. The air distribution unit of claim 9 wherein the at least one fan is disposed in the upper plenum in fluid communication with the exhaust vent and in fluid communication with the lower plenum and the intake vent.

11. The air distribution unit of claim 10 wherein the midplate defines at least one intake port, the at least one intake port being associated with a corresponding fan disposed in the upper plenum, and wherein the fan is configured and disposed such that at least a portion of the fan aligns with the corresponding intake port, each fan being
5 configured to draw air from the lower plenum through the corresponding intake port into an interior of the fan and to force drawn-in air radially outward through the exhaust vent.

12. The air distribution unit of claim 11 wherein the upper plenum includes one or more dividing walls disposed between the top panel and the midplate to divide the upper
10 plenum into one or more air paths, and wherein the at least one fan is disposed in one of the air paths, the air path in which the at least one fan is disposed being in fluid communication with the exhaust vent.

13. The air distribution unit of claim 12 wherein the lower plenum includes one or
15 more dividing walls disposed between the midplate and the bottom panel that divide the lower plenum into one or more air paths, and wherein the at least one intake port is in fluid communication with one of the air paths, the air path in fluid communication with the at least one intake port being in fluid communication with the intake vent.

14. The air distribution unit of claim 10 further comprising multiple power inputs and
a control circuitry module electrically coupling the power inputs to the at least one fan,
the control circuitry module being configured to disconnect a first of the power inputs
from a first fan and connect a second of the power inputs to the first fan in response to a
5 loss of power on the first power input.

15. The air distribution unit of claim 1 further comprising an air manifold coupled to
the side panel of the housing in fluid communication with the exhaust vent and
configured to collect air the fan forces outward through the exhaust vent and to direct air
10 from the exhaust vent.

16. The air distribution unit of claim 15 wherein the air manifold is disposed and
configured to direct air from the exhaust vent in one of an upward direction and a
downward direction such that air flows along one of a left side of the rack and a right side
15 of the rack.

17. The air distribution unit of claim 16 wherein the air manifold is configured as a
scoop.

20 18. The air distribution unit of claim 16 wherein the air manifold includes an exhaust
grill along its side that directs air, the exhaust grill defining a plurality of openings
configured to allow air to pass therethrough.

19. The air distribution unit of claim 16 wherein the air manifold includes a brush grommet connected along an outer longitudinal portion of the air manifold such that when the rack is disposed in an equipment enclosure and the air manifold is coupled to the housing of the side air distribution unit, the brush grommet is adjacent a side wall of
5 the equipment enclosure.

20. The air distribution of claim 16 wherein the air manifold is configured as an air tube defining an interior chamber and a plurality of openings along a first side in fluid communication with an area external to the air tube such that when the air manifold is
10 coupled to the side panel of the housing, the plurality of openings are disposed to permit air contained within the interior chamber to pass through one or more of the openings.

21. The air distribution unit of claim 20 wherein one of a length and a width of the air tube is configured such that the plurality of openings are disposed in relation to the rack-mounted equipment to permit air to pass through one or more of the openings to the
15 equipment.

22. The air distribution unit of claim 16 wherein the air manifold includes a baffle configured to pivot along one longitudinal edge in response to contact with air venting
20 from the exhaust vent and further configured to be disposed at an angle to direct air in one of an upward direction and a downward direction.

23. An air distribution unit for use in a rack that holds rack-mounted equipment, the air distribution unit comprising:

a housing defining an interior chamber, at least one intake vent defined in a bottom panel of the housing and configured to provide fluid communication between the 5 interior chamber and an area external to the housing, and at least one exhaust vent defined in a side panel of the housing, the housing being configured to be disposed in the rack and to direct air from the interior chamber substantially laterally through the at least one exhaust vent when coupled to the rack; and

at least one fan coupled to and disposed within the housing parallel to a top panel 10 and a bottom panel of the housing and configured to draw air from the area external to the housing through the at least one intake vent, and to force the drawn-in air out of the air distribution unit through the at least one exhaust vent.

24. The air distribution unit of claim 23 wherein the housing is configured to be

15 mounted into the rack such that the bottom panel of the housing is disposed adjacent a bottom side of the rack.

25. The air distribution unit of claim 23 wherein the housing includes a midplate

disposed in the interior chamber and spaced from and parallel to a top panel of the 20 housing and a bottom panel of the housing, the midplate dividing the interior chamber into two plenums, wherein an upper plenum is defined between the top panel and the midplate in fluid communication with the exhaust vent and a lower plenum is defined

below the upper plenum between the midplate and the bottom panel in fluid communication with the intake vent.

26. The air distribution unit of claim 25 wherein the at least one fan is disposed in the
5 upper plenum in fluid communication with the exhaust vent and in fluid communication with the bottom plenum and the intake vent.

27. The air distribution unit of claim 26 wherein the midplate defines at least one intake port, the at least one intake port being associated with a corresponding fan
10 disposed in the upper plenum, and wherein the fan is configured and disposed such that at least a portion of the fan aligns with the corresponding intake port, each fan being configured to draw air from the bottom plenum through the corresponding intake port into an interior of the fan and to force drawn-in air radially outward through the exhaust vent.

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28. The air distribution unit of claim 27 wherein the lower plenum includes the at least one intake vent defined in the bottom panel, the at least one intake vent being associated with a corresponding fan disposed in the upper plenum, and wherein the fan is configured and disposed such that at least a portion of the fan aligns with the corresponding intake vent, each fan being configured to draw air from the intake vent through the bottom plenum and into the corresponding intake port of the midplate.

29. The air distribution unit of claim 28 wherein the at least one intake vent is disposed along the bottom panel of the housing and configured to connect to a raised floor configuration such that the intake vent can receive cool air the raised floor configuration supplies.

5 30. The air distribution unit of claim 29 wherein the at least one intake vent is further disposed and configured such that it mates with a boot, the boot being configured to extend from the intake vent and removably connect to a cool air inlet of the raised floor configuration.

10 31. The air distribution unit of claim 25 wherein the upper plenum includes one or more dividing walls disposed between the top plate and the midplate that divide the upper plenum into one or more air paths, and wherein the at least one intake port is disposed in fluid communication with one of the air paths, the air path with which the intake port is in fluid communication being in fluid communication with the exhaust vent.

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32. The air distribution unit of claim 26 further comprising multiple power inputs and a control circuitry module electrically coupling the power inputs to the at least one fan, the control circuitry module being configured to disconnect a first of the power inputs from a first fan and connect a second of the power inputs to the first fan in response to a 20 loss of power on the first power input.

33. An air distribution system for use in a rack that holds rack-mounted equipment, the system comprising:

an air distribution unit including a housing defining an interior chamber, at least one intake vent defined in a front panel of the housing and configured to provide fluid communication between the interior chamber and an area external to the housing, and at least one exhaust vent defined in a side panel of the housing, the housing being configured to be disposed in the rack and to direct air from the interior chamber substantially laterally through the at least one exhaust vent when coupled to the rack;

at least one fan coupled to and disposed within the housing and configured to draw air from the area external to the housing through the at least one intake vent, and to force the drawn-in air out of the air distribution unit through the at least one exhaust vent; and

a baffle plate configured to connect along a rear vertical rail of the rack and further configured to extend from the rear vertical rail to a rear portion of one or more components of the rack-mounted equipment, the baffle plate being disposed to inhibit flow of exhaust air from an area at the back of the rack to an area along a side of the rack.

34. A modular air distribution unit for use in a rack that holds rack-mounted equipment, the rack-mounted equipment having side air intake vents, the air distribution unit comprising:

a housing;

5 a fan connected to the housing and configured to draw air from a first region external to the housing into a second region internal to the housing and to force the air from the second region into a third region internal to the housing in which the fan is disposed; and

means for directing the air forced into the third region laterally through at least
10 one side exhaust vent defined in the housing and adjacent the side air intake vents of the rack-mounted equipment.

35. The air distribution unit of claim 34 further comprising means for directing the air vented from the at least one side exhaust vent in one of an upward direction and a
15 downward direction along one of a left side and a right side of the rack.

36. An equipment enclosure comprising:

an enclosed housing including a top panel, a bottom panel, a first side panel, a second side panel, a front panel having formed therein a number of openings to allow air to flow through the openings into an interior of the enclosed housing, and a rear panel
5 having formed therein a number of openings to allow exhaust air to vent from within the interior to an area external to the enclosed housing;

an internal frame centered in the interior and spaced from the first side panel and the second side panel and coupled to the top panel and the first and the second side panels to allow mounting of equipment in an equipment area formed by the internal frame; and

10 an air distribution unit mounted to the internal frame within the equipment area defining an interior chamber, the air distribution unit having at least a first intake vent disposed in fluid communication with the chamber and the openings of the front panel and at least a first fan disposed in the chamber, the first fan being in fluid communication with the at least first intake vent and at least a first side exhaust vent disposed in fluid communication with the chamber, the first fan being further disposed and configured to draw air from the openings of the front panel through the at least first intake vent into the chamber, and to force drawn-in air from the chamber through the at least first side exhaust vent to an area external to the air distribution unit defined between one of the internal frame and the first side panel and the internal frame and the second side panel.
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37. The equipment enclosure of claim 36 further comprising an air manifold coupled to the at least one side exhaust vent such that the air manifold collects air venting from the at least one side exhaust vent, the air manifold being disposed and configured to direct flow of air in one of an upward direction and a downward direction along the area external to the air distribution unit.

38. A method of cooling equipment components disposed in a rack of equipment components, the components being disposed above one another in the rack, the components including fans to draw gas from first sides of the components through the components and to expel the air from opposite second sides of the components, the method comprising:

drawing air from a first region external to and near a front of the rack;
guiding the air into the front of the rack and a second region of the rack disposed within an equipment area defined by the rack in which the components are rack-mounted; and
forcing the air laterally from the second region into a side region external to a side of the rack adjacent the first sides of the components while inhibiting the air from being forced into portions of the rack other than the side region external to the side of the rack.